



NEW DATA ON SOUTH AMERICAN SPECIES OF *CHORDODES* (NEMATOMORPHA) ¹

(With 7 figures)

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ABSTRACT: Taxonomic characters of both male and female horse-hair worms *Chordodes brasiliensis*, and *C. nobilii* (Nematomorpha) and female of *C. carmelitanus* are re-described by scanning electron microscopy. Sexual dimorphism was found in the cuticular pattern of *C. brasiliensis*, the male has three different areolar types but the female shows five different areolar types that includes all three types of areoles as in the males, but along the ventral and dorsal midline, two further types of areoles are present.

The female cuticle of *C. carmelitanus* is characterized by three types of areoles, the crown areoles always occur in pairs on both sides along the ventral midline. Male of *C. nobilii* has two types of areoles, type 1 are slightly oval or circular in shape with minute projections on the apical surface. Type 2 areoles occur individually or in clusters and carry on their apical surface projections that can be short or longer. The female of this species has three types of areoles. Areoles of types 1 and 2 are very similar to each other. Crowned areoles (type 3) have quite long apical filaments and occur only along the ventral and the dorsal midline. A neotype of *nobilii* is erected as the original material cannot be traced. Host data of *C. brasiliensis* and new distribution records of *C. brasiliensis* and *C. nobilii* are reported.

Key words: Nematomorpha, Gordiida, *Chordodes*, South America, scanning electron microscopy.

RESUMO: Novos dados sobre espécies sul-americanas de *Chordodes* (Nematomorpha).

Neste trabalho estão sendo redescritas com microscopia de varredura, três espécies de *Chordodes*, *C. brasiliensis*, *C. carmelitanus* e *C. nobilii*. Macho do *C. brasiliensis*, com cutícula provida com três tipos de aréolas, as fêmeas apresentam dimorfismo sexual com cinco tipos de aréolas, dois tipos das quais encontram-se na linha ventral do corpo. A fêmea de *C. carmelitanus* com cutícula com aréolas de três tipos, apresentam na região ventral, longitudinalmente, uma faixa tendo aréolas coroadas pares no meio das quais saem tufo de prologamentos muito longos. O macho de *C. nobilii* com dois tipos de aréolas, tipo 1 de forma oval ou arredondadas tendo no ápice finos e curtos prolongamentos. Aréolas do tipo 2 apresentam-se isoladas, aos pares ou em grupos tendo no ápice prologamentos curtos ou longos. As fêmeas de *C. nobilii* com três tipos de aréolas. Nas aréolas do tipos 1 e 2 são semelhantes. O tipo 3 (aréolas coroadas) na linha ventral do corpo, apresentam no ápice prolongamentos longos. Outorga-se informações sobre hospedeiros do *C. brasiliensis* e novos dados da distribuição geográfica do *C. brasiliensis* e de *C. nobilii*.

Palavras-chave: Nematomorpha, Gordiida, *Chordodes*, América do Sul, microscópio de varredura.

INTRODUCTION

The biodiversity of horsehair worms (Nematomorpha) from southern South America, in particular Argentina, is comparatively well known (see, among many publications, MIRALLES & DE-VILLALOBOS, 1993). However, still several species from Argentina and more from the remaining South America are insufficiently known. Scanning Electron Microscopy has become the standard method in nematomorph taxonomy, because the

fine cuticular characters can be documented reliably with this method. We investigated here representatives of the genus *Chordodes* from different museum collections. *Chordodes* contains about 90 species and is the largest genus in Nematomorpha. The cuticular structure is usually very diverse, with several types of elevations called areoles. Characteristic for *Chordodes* are the so-called crowned areoles which are elevated above the surface and have an apical ring ("crown") of shorter or longer filaments.

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One of the best known species from South America is *Chordodes brasiliensis* Janda, 1894, but descriptions of this species, differ slightly between different specimens. JANDA (1894), in his original description mentions three types of areoles, an abundant flat one, a highly elevated one with fine apical filaments and irregularly distributed solid spines. The first two types were confirmed by subsequent descriptions, whereas the spines probably represent so-called tubercle areoles in which a fingerlike projection arises from a flat areole (MIRALLES, 1969). CAMERANO (1897a) described crowned areoles with very long filaments next to the dorsal and ventral midline in the female, a fact that was repeated in later descriptions (MIRALLES, 1976), but not confirmed by independent investigations (CARVALHO, 1946a, 1946b; CARVALHO & FEIO, 1950; MIRALLES & CAMINO, 1983; MIRALLES, 1993).

We additionally reinvestigated the holotype of *Chordodes carmelitanus* Carvalho & Feio, 1950. Scanning Electron Microscopical observations were already available from new recorded specimens (MIRALLES, 1989), but the investigation of the holotype could add new details. Finally, several specimens from the collection of the Museo de Ciencias Naturales in La Plata, Argentina, correspond to description of *Chordodes nobilii* Camerano, 1901. Because the holotype could not be located, we describe a neotype for this species.

MATERIAL AND METHODS

Preserved specimens from the following museums were investigated: Museo de Ciencias Naturales de La Plata (MLP), Museum für Naturkunde, Berlin, Germany (MNB), Museu Nacional of Rio de Janeiro, Brazil (MNRJ), Museo Regionale di Scienze Naturali, Torino (MZUT) and Natural History Museum, London, UK (NHML). All the preserved specimens were fixed in ethanol. In the present study we investigated twenty nine specimens of *Chordodes brasiliensis*, one of *C. carmelitanus* and twenty of *C. nobilii* and we report new records of *Chordodes brasiliensis* and *C. nobilii*. In order to optimize the traditional observation technique, we followed the new protocol propoused by SCHMIDT-RHAESA (2002a). Body measurements were made with outstretched worms using a ruler. Diameters were measured under dissecting microscope using a caliper ruler. Fragments of worms (anterior end, mid-body and posterior end) were dehydrated in an increasing ethanol series, critical point-dried,

mounted on bronze blocks and gold-sputter coated. Observations were performed using a JEOL SLM 1000 scanning electron microscope.

RESULTS

Chordodes brasiliensis Janda, 1894 (Figs.1-2)

1894 *Chordodes brasiliensis* Janda – Zool. Jahrb. Syst. Geogr. Tiere, 7:608, pls:19-20.

Holotype (no examined) – One male from Brazil (no further precision of locality) (JANDA, 1894).

Material examined – SEM. Midbody from: 1♂ (Córdoba: Alta Gracia, Argentina, MLP 3575); 1♂ (Corrientes, Capital, Argentina, MLP 5049); 1♀ (Corrientes, Capital, Argentina, MLP 5052); 10♂, 2♀ (Salta: Tala, Argentina, MZUT G2, G42); 1♀ (Salta Capital, Argentina, MLP 5052); 1♂ (Rio Noro, Humboldt, Station Catherina, NHML 1921.12.13.23-24); 1♂ (San Luis: El Reparito, Estancia Grande, Argentina, MLP 3574); 1♀ (Jujuy: San Lorenzo, Argentina, MZUT G46); 1♂, 2♀ (Tucumán: Las Tipas river, Argentina, MLP 3578); 1♂ (Misiones, Parque Nacional Iguazú, Base Yawi, Argentina, MLP 4903); 1♀ (Misiones: Cuña Pirú stream, Argentina, MLP 5050); 1♂ (Rio de Janeiro, Brazil, MNRJ 5348); 1♂ (Niterói, Brazil, MNRJ, no accession number); 1♀ (Japuhiba, Brazil, MNRJ no accession number); 1♀ (Viçosa, Brazil, MNRJ no accession number); 1♀ (Santa Teresa, Brazil, MNRJ no accession number). SEM from terminal end: 1♂ (Salta: Tala, Argentina, MZUT G2), 1♂ (Rio Noro, Humboldt, Station Catherina, NHML 1921.12.13.23-24), 1♀ (Corrientes, Capital, Argentina, MLP 5052). LM of midbody from 25♂ (Salta: Tala, Argentina, MZUT G2).

Host – MANTODEA: *Stagmatoptera hyaloptera* (see CAMERANO, 1897b), *Stagmatoptera* sp. (see CARVALHO, 1946a), *Stagmatoptera precaria* (see CARVALHO, 1946b), undetermined mantid (see CARVALHO, 1946b), probably *Phyllovates* sp. (see SCHMIDT-RHAESA & EHRMANN, 2001).

♂ – Color of body varies between light brown to dark brown. Posterior end of males (Fig.1A) is not bilobed. The cloacal opening is oval and surrounded by slender spines (circumcloacal spines). Around the cloacal opening the cuticle is smooth with minute bristles. Anterolateral of the cloacal opening are two straight and narrow rows of bristles. They reach up to 250µm in length.

The cuticle shows three types of areoles (Fig.1C-F). Type 1 areoles are the most abundant, they are oval

with an irregular shape and a roughly structured surface (Fig.1C-F). Scattered among these areoles are areoles of type 2 (tubercle areoles) with a long (15.7µm) fingerlike projection (tubercle) which is in an excentric position on the areole (Fig.1D, E). Both areolar types are transversal to the longitudinal axis of the body. Areoles of type 3 are distinctly elevated over the other areoles (up to 21.5µm). They occur abundantly, but individualized and are scattered between the areoles of type 1 (Fig.1C, F). Rarely they form loose clusters of up to four areoles (Fig.1F). The apical surface of these areoles differ between specimens, is rugged (MLP 4903) (Fig.1F) or with very fine processes (MNRJ 5348) (Fig.1D).

♀ – Color of body as in males, it varies between light brown to dark brown. The posterior end (Fig.2A) is rounded and the cloacal opening is circular with a central terminal position. Radiating around the cloacal opening are fine grooves (Fig.2A).

The cuticle includes all three types of areoles as in the males (Fig.2B, C), but along the ventral and dorsal midline, two further types of areoles are present. Both additional types are clustered together. Two kinds of filaments, one very long and solid, the other much thinner and shorter, arise from a more or less flat region which probably represents two areoles (Fig.2C). These central areoles are surrounded by 5-6 slightly elevated areoles which are curved towards the center (Fig.2C).

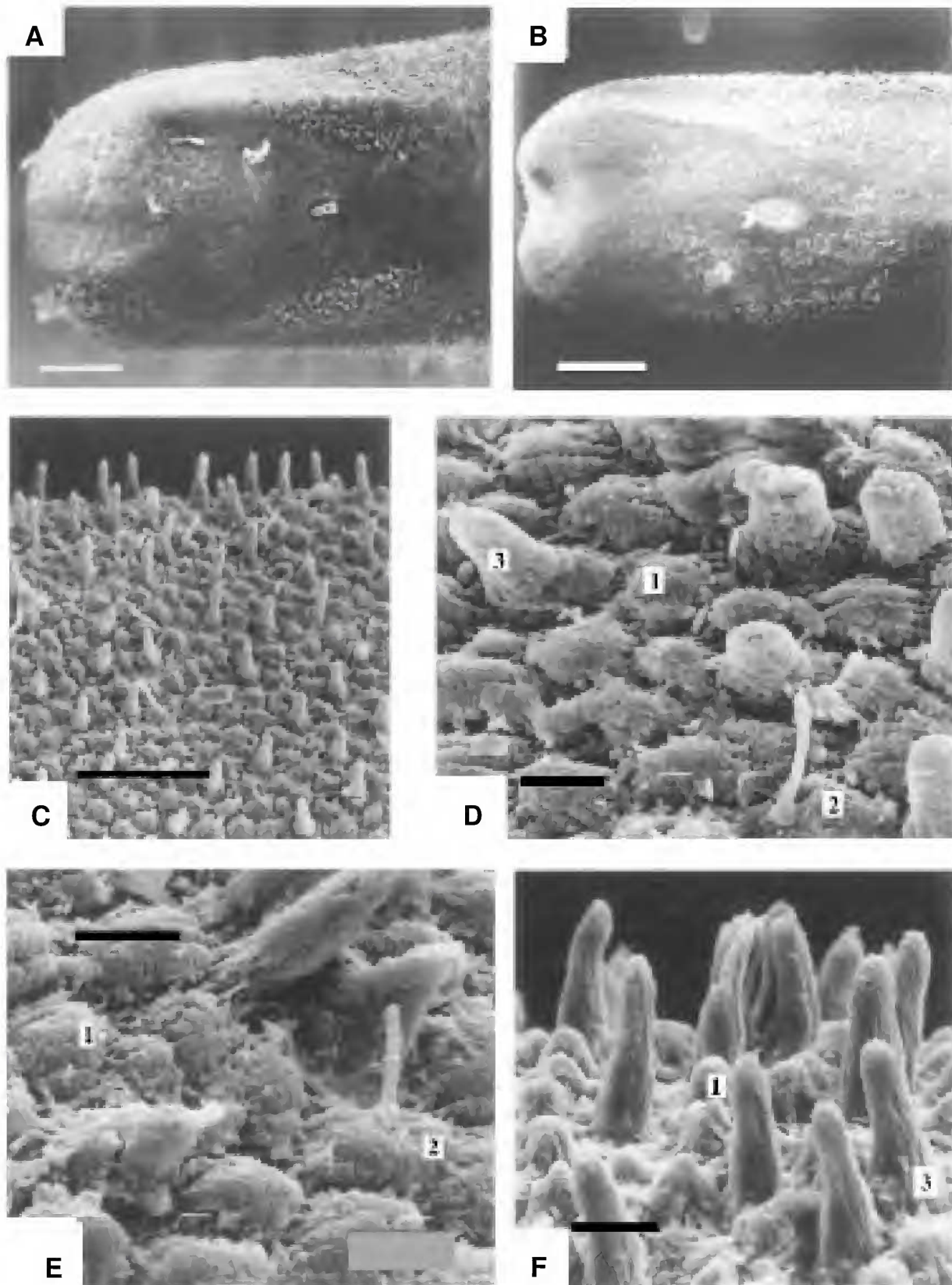
Dimensions – According to the literature (CAMERANO, 1897b; CARVALHO, 1946a; CARVALHO & FEIO, 1950; MIRALLES & CAMINO, 1983) females vary between 140 and 271mm in length and are maximally 2mm in diameter; males range from 85 to 355mm in length and from 0.7 to 2mm in diameter. Measurements of the newly reported specimens range in length from 63 to 206mm in males and from 112 to 240mm in females. The diameter varies between 0.5 to 1.0mm in males and between 0.6 and 1.8mm in females

Comments – CAMERANO (1897b) designates “numerous” specimens as *Chordodes brasiliensis*, in our SEM and LM reinvestigation we have analyzed all of these specimens (54♂ and 1♀) and we can confirm that only 35 males belong to *C. brasiliensis*, and the rest of the specimens (19♂ and 1♀) to *Neochordodes talensis*.

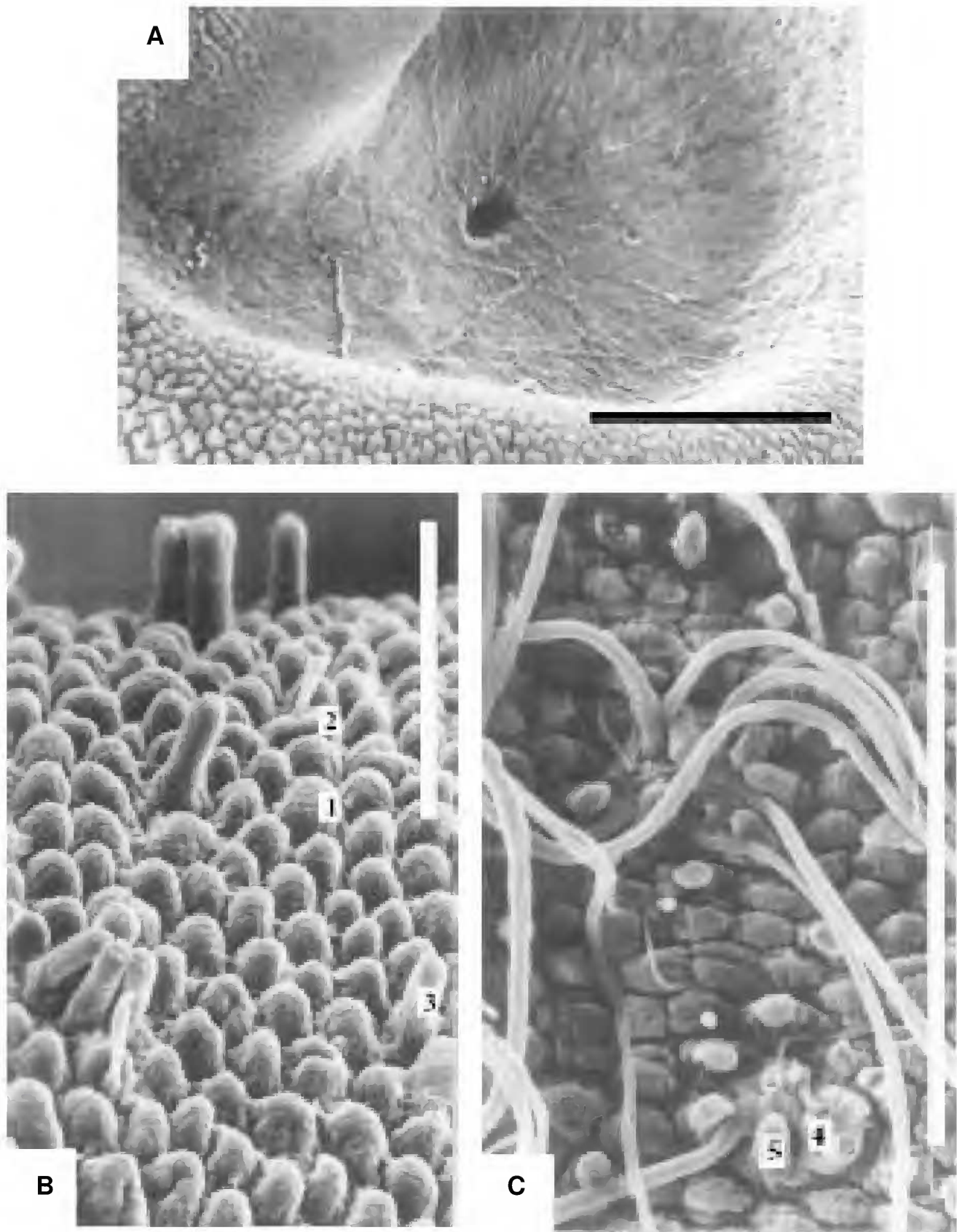
Our study confirmed the areolar types from previous investigations, *i.e.*, the abundant flat areoles, highly elevated areoles and tubercle areoles (see JANDA, 1894; CAMERANO, 1987a, 1987b; CARVALHO, 1946a, 1946b; CARVALHO & FEIO, 1950; MIRALLES

& CAMINO, 1983). Additionally, we could confirm the presence of further areoles in the female as noted by CAMERANO (1897a). Camerano reports paired areoles (“papille”) with long processes, but in his figures the paired character of areoles is not evident. Instead, filaments seem to originate from a broad region. This is in accordance with our findings, where filaments can not clearly be assigned to one areole. As paired crowned areoles with long filaments, surrounded by a circle of elevated areoles, are a common character in *Chordodes* (see, *e.g.*, SCHMIDT-RHAESA, 2002a, 2002b), it can be assumed that the structures in *C. brasiliensis* represent modified crowned areoles. The presence of two kinds of filaments, thick and thin, however, is new and unique for *C. brasiliensis*. CAMERANO (1897a) figured elevated areoles surrounding the areoles with the long filaments, including a curvation towards the center, but did not mention these as a particular type of areoles. What remains questionable is the nature of the abundant elevated areoles on the cuticular surface. As these may carry small processes, they might represent some form of crowned areoles. We think that future studies will allow a better idea about the real identity of these areoles.

Distribution – ARGENTINA - Buenos Aires: Sierra de la Ventana, Cerro Tres Picos (3♂, de Miralles & Camino, 1983), Arroyo El Loro, Río Sauce Grande (8♂, 4♀, MIRALLES, 1980). Córdoba: Alta Gracia, La Granja stream (2♀, MIRALLES, 1976), Alta Gracia 31°40'00"S, 64°24'00"W (1♂, new record). Corrientes: Corrientes Capital 27°28'S, 58°49'W (1♂, 1♀, new record). Entre Ríos: Gualaguaychú (1♂, CARVALHO, 1946a). Jujuy: San Lorenzo (2♀, CAMERANO, 1897a). Misiones: Puerto Bembey (3♂, 2♀, CARVALHO & FEIO, 1950), Cuña Pirú stream 27°08'00"S, 54°54'00"W (1♀, new record), Parque Nacional Iguazú, Base Yawi 25°36'00"S, 54°34'00"W (1♂, new record). Salta: Tala (35♂, 2♀, CAMERANO, 1897a), Salta capital 24°51'00"S, 65°29'00"W (1♀, new record). San Luis: El Reparito, Estancia Grande (1♂, MIRALLES, 1976). Tucumán: Las Tipas river (1♂, 2♀, MIRALLES, 1984, 1993). BRAZIL - Espírito Santo: Santa Teresa 20°06'02"S, 40°31'47"W (2♂, 3♀, CARVALHO, 1946b); Rio de Janeiro: 22°55'00"S, 43°30'00"W (1♂, new record), Niterói 22°56'00"S, 43°04'00"W (1♂, new record), Cachoeira de Macacu, Japuhiba 22°27'24"S, 42°39'24"W (1♀, new record), Minas Gerais: Viçosa 20°45'39"S, 42°52'10"W (1♀, new record). URUGUAY: Nueva Palmira (1♂, CARVALHO, 1946a), Tacuarembó (1♂, CARVALHO, 1946a), Mercedes (1♂, CARVALHO, 1946a), Paysandú (1♂, 1♀, CARVALHO, 1946a), unspecified location (CAMERANO, 1915).



Chordodes brasiliensis, ♂, SEM - fig.1- (A) posterior end (MZUT G2) unlobed; (B) posterior end (NHM 13) with a ventral groove and two lobe like structures; (C) midbody cuticle, general view (MZUT G2); (D) midbody cuticle, detail of areoles types 1, 2 and 3; (E) midbody cuticle, detail of areoles types 1 and 2 (MNRJ 5348); (F) midbody cuticle, lateral view showing areole type 3 (MLP 4903). Scale bars: (A-C) = 100µm, (D-F) = 10µm.



Chordodes brasiliensis, ♀, (MLP 5050), SEM – fig.2- (A) terminal end with radiating grooves (arrow) around the cloacal opening; (B) midbody cuticle, lateral side with type 1- 3 areoles; (C) midbody cuticle, ventral midline with areolar clusters with types 3 and 4 (crowned areoles). Scale bars: (A and C) = 100 μ m, (B) = 50 μ m.

Chordodes carmelitanus Carvalho & Feio, 1950
(Fig.3)

1950 *Chordodes carmelitanus*. Carvalho & Feio. Ann. Acad. Bras. Cienc., 22:197, pls.4-6.

Holotype – 1♀ from Fazenda da Alegria, Carmo do Rio Claro, Minas Gerais, Brasil. (Museu Nacional of Rio de Janeiro, Brasil, no accession number).

Material examined (holotype) – SEM of midbody. 1♀ (Cordoba: San Lorenzo Stream, Cura Brochero, Argentina, MLP 3579), 2♀ ♀ (Buenos Aires: Sierra de la Ventana, Argentina, MLP 3580).

Host – Unknown.

Redescription of holotype – Body length 220mm and diameter in the middle region 1.8mm. Body colour dark brown. Terminal end rounded and the cloacal opening situated terminally.

The cuticle contains three types of areoles. Areoles of type 1 and 2 are oval or rounded (Fig.3A, B), moderately elevated and with superficial or deep grooves in perpendicular direction to the body axis. The interareolar spaces between areoles type 1 and 2 are broad, structured into cord-like folds and contain scattered small protuberances. Type 1 areoles are the most abundant and among these there are scattered type 2 areoles with a short tubercle on the top that seems to originate from a depression. Crowned areoles (third type of areoles) always occur in pairs which are densely surrounded by a circle of areoles of type 1 (Fig.3B-D). They contain long slender apical filaments (up to 297µm).

Comments – Our reinvestigation in general confirms the description of CARVALHO & FEIO (1950), but differs in the interpretation. As first type of areoles, CARVALHO & FEIO (1950) described very small areoles. Observed with SEM, these areoles turn out to be irregular elevations of the cordlike structures in the interareolar space. Under lower magnifications (e.g., Fig.3D), these structures appear as areoles, but under higher magnifications, they do not possess a defined margin and are therefore not regarded as areoles by us. CARVALHO & FEIO (1950) summarized what we have called areoles type 1 and 2 as one type, but also noted the distribution of crowned areoles along the ventral midline.

Specimens from Buenos Aires and Córdoba (Argentina), reported by MIRALLES (1989) as *C. carmelitanus*, differ from the holotype and therefore we transferred them to the species *C. nobilii* (see next).

Distribution – BRAZIL - Minas Gerais: Carmo do Rio Claro (1♀, CARVALHO & FEIO, 1950).

Chordodes nobilii Camerano, 1901
(Figs.4-6)

1901 *Chordodes nobilii* Camerano. Boll. Mus. Zool. Anat. Comp. Torino, 16(410):1

Holotype – 1♀ from Cosquin, Cordoba, Argentina could not be located and seems to be lost.

Neotype – 1♂ (San Luis: Carpinteria, Piedra Blanca stream MLP 5290/1). Paraneotypes: 2♂ (San Luis: Carpinteria, Piedra Blanca stream MLP 5290/2).

Material examined – SEM of midbody (all reports from Argentina): Neotype 1♂ (San Luis: Carpinteria, Piedra Blanca stream MLP 5290/1), Paraneotypes 2♂ (San Luis: Carpinteria, Piedra Blanca stream MLP 5290/2), 1♂ (Buenos Aires: Sierra de la Ventana, El Loro stream, MLP 5063), 1♂ (MLP 5063), 3♀ (Buenos Aires: Sierra de la Ventana [as *C. carmelitanus*, MIRALLES, 1989], MLP 3580), 4♂ (Buenos Aires: Sierra de la Ventana, Sauce Grande stream, MLP 3582), 1♀ (Buenos Aires, Balcarce, MLP 5055); 1♂ (Cordoba, El Durazno, MLP 5291) 2♀ (Cordoba, MNB 4437), 1♀ (Cordoba: Cura Brochero, San Lorenzo stream [as *C. carmelitanus*, MIRALLES, 1989], MLP 3579), 2♂ and 1♀ (San Luis: Villa Larca, Aguas Blancas, San Ignacio stream, MLP 5289). SEM terminal end: Neotype 1♂ (San Luis: Carpinteria, Piedra Blanca stream MLP 5290/1). 1♂ (Buenos Aires: Sierra de la Ventana, Sauce Grande stream, MLP 3582), 1♂ (Cordoba, El Durazno, MLP 5291), 1♀ (Buenos Aires, Balcarce, MLP 5055).

Host – Unknown.

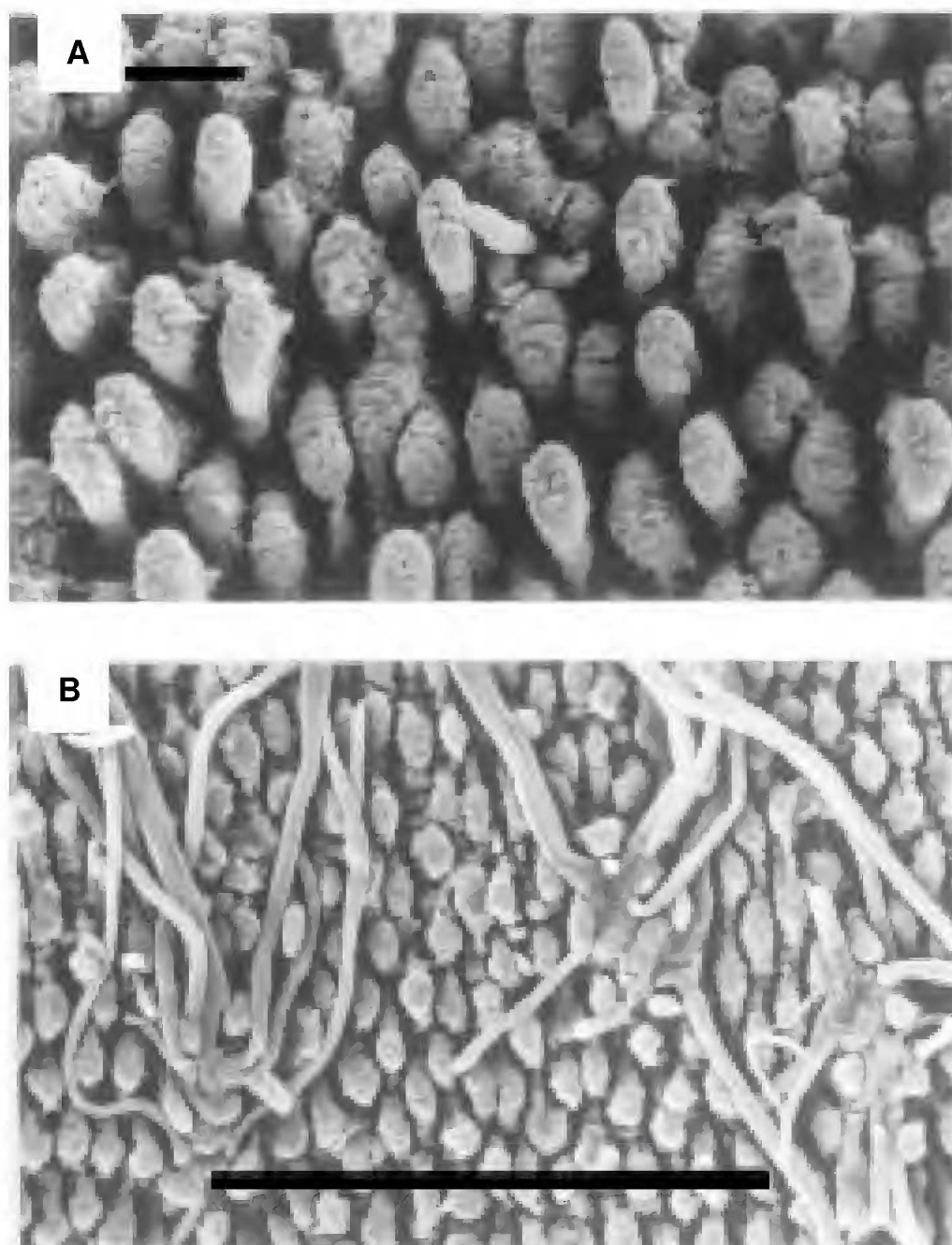
♂ – The body color ranges from light to dark brown. The anterior end is tapered and a dark collar is always lacking. The posterior end in most of the males is not divided into lobes (Fig.4A), but in two specimens we found a clear indication of two lobes at the ventral side of the posterior end (Fig.4C). The cloacal opening is round or oval and is surrounded by slender spines undivided at the top (circumcloacal spines) (Fig.4A-C). Anterolateral of the cloacal opening are paired regions in which numerous bristles are located (bristlefields). In the anterior and posterior region of the cloacal opening are short spines.

The body cuticle is densely structured by areoles. There are two types of areoles. The most abundant type (type 1) are slightly oval or circular in shape and have a warty surface (“blackberry-like”). Irregular minute projections are distributed on the whole apical surface (Fig.5B). Type 2 areoles are slightly larger than the first type and carry on their apical surface projections which are not scattered, but clustered. These projections can be extremely

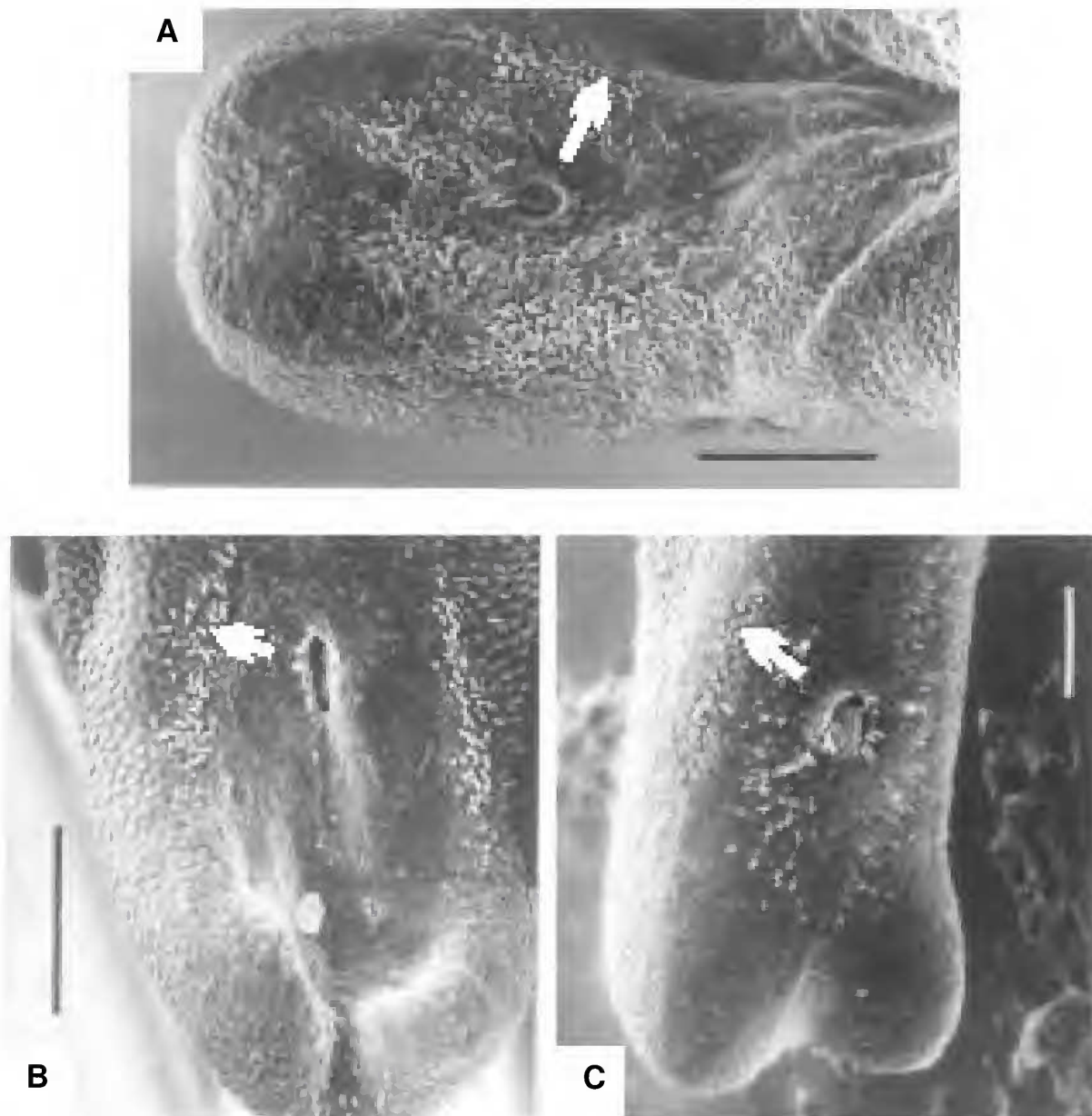
short or slightly longer and bristlelike (Fig.5A-D). Type 2 areoles occur individually or in clusters of 3 to 10 areoles. The cuticle between the areoles is structured into cord-like folds and there are scarcely distributed tubercles emerging among type 1 areoles (Fig.5A, D).

♀ – Posterior end round with a terminal cloacal opening. Radiating around the cloacal opening are fine

grooves (Fig.6A). In the cuticle, the same types of areoles are present as in the male, with additional crowned areoles. Areoles of types 1 and 2 are very similar to each other (Fig.6B, C). Crowned areoles (type 3) occur only along the ventral and the dorsal midline (Fig.6D, E). They have quite long apical filaments and appear in a cluster of two areoles (Fig.6E). The surrounding areoles are from type 1 (Fig.6E).



Chordodes carmelitanus, ♀ holotype, SEM – fig.3- (A) cuticle of midbody with type 1 areole and tubercle areoles (type 2), scale bar = 100µm; (B-D) ventral midline. Areolar clusters with types 3 and 1 (crowned areoles), scale bar = 10µm.

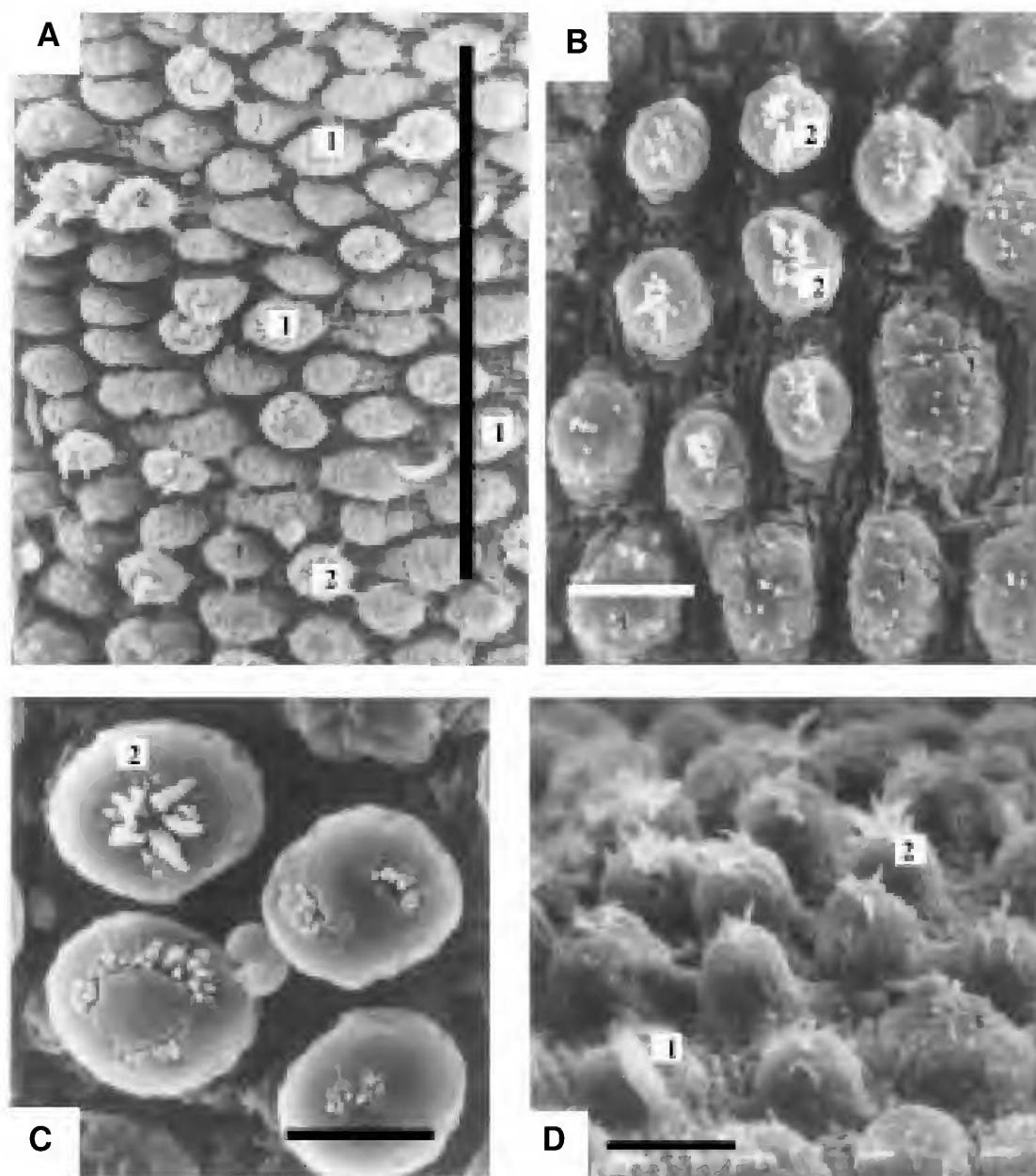


Chordodes nobilii, ventral view on male terminal end. SEM – fig.4- (A) Neotype (MLP 5290/1) undivided. (B) MLP 5291 and (C) MLP3582, with a ventral groove and two lobe like structures; (A-C) ventral cloacal opening with circumcloacal spines, anterolateral bristles (bristlesfield) (arrows) and posterior spines scale bar = 100µm.

One female from the Museum für Naturkunde Berlin (MNB 4437) differed from the remaining females in that areoles of type 2 areoles are larger than the first type and crowned areoles are surrounded by slightly elevated areoles (Fig.7A, B). Dimensions – According to the literature, females vary between 149 and 386mm in length and are maximally 1.5mm in diameter (CAMERANO, 1901,

1915; MIRALLES, 1989). Measurements of the newly reported specimens range in length from 82 to 255mm in males and from 219 to 290mm in females. The diameter varies between 0.6 to 1.1mm in males and between 0.9 to 1.3mm in females.

Remarks – The holotype of *Chordodes nobilii* seems to be lost. It was originally described in the journal of the Museum für Zoologie und Comparative



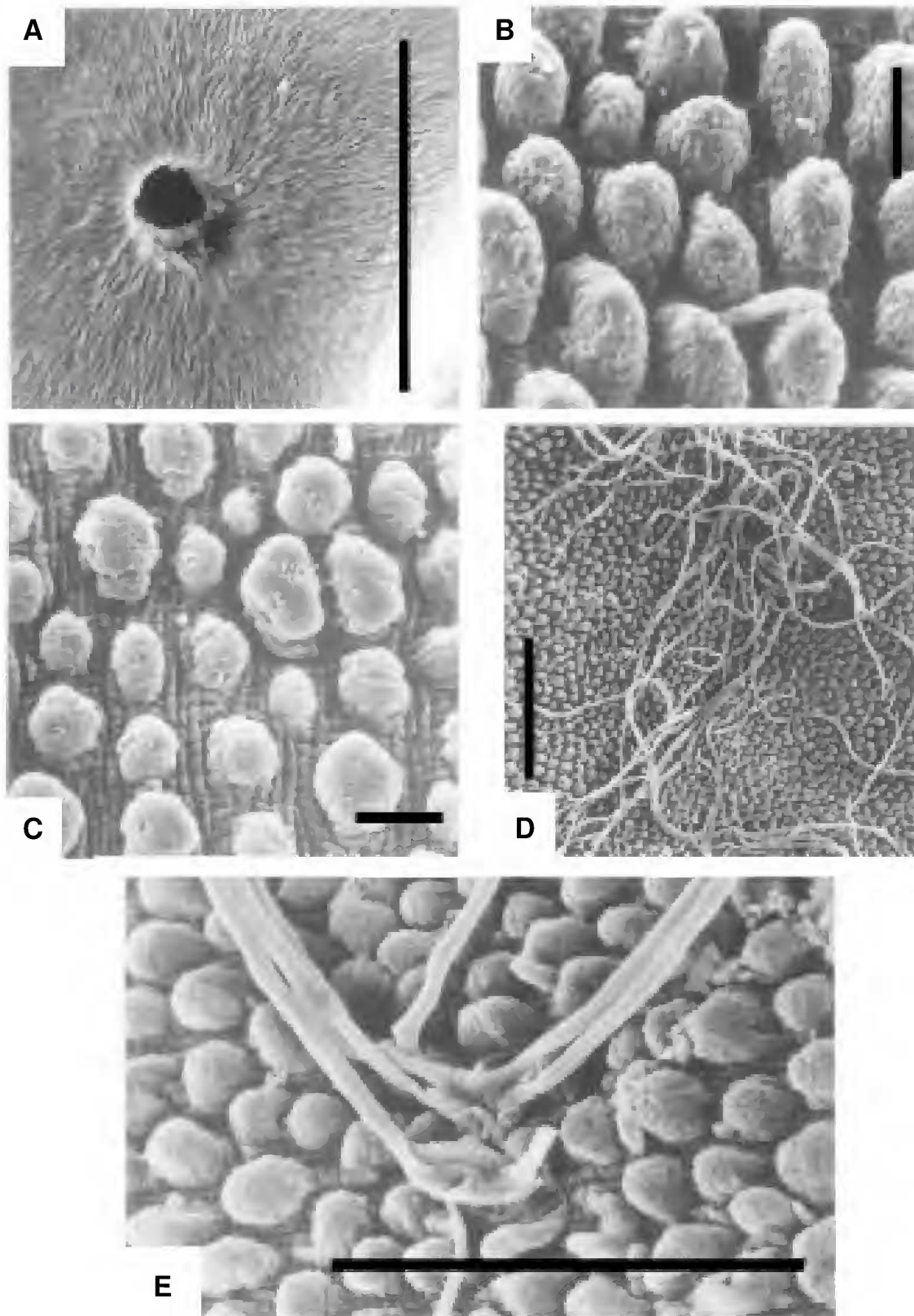
Chordodes nobilii midbody cuticle of males. SEM – fig.5- (A-D) areolar type 1 and crowned areoles (type 2): (A) neotype, MLP 5290/1, general view of the cuticle showing tubercles between type 1 areoles and single and clusters of crowned areoles (type 2), scale bar = 100 μ m; (B) MLP 5063: type 1 areoles, group of crowned areoles (type 2) and structure of the interareolar cuticle with cord-like folds; (C) MLP 5063, lateral view of the cuticle; (D) MLP 3930/2, cluster of crowned areoles with smooth surface, some of them with retracted filaments. (B-C) scale bar = 10 μ m.

Anatomy in Turin, Italy, but is not present there, nor could be located in any other collection. The original description (Camerano 1901) as well as later references to this species (CAMERANO, 1915; MIRALLES, 1969, 1976) did not include figures. Nevertheless, the description corresponds well with the specimen designed here as neotype.

The reexamination of two female specimens housed

in the Museum fur Naturkunde Berlin (MNB 4437) from Cordoba as *Chordodes nobilii* demonstrates that one of them differed slightly, but may still belongs to *C. nobilii* but the other belongs to *Pseudochordodes bedriagae* (see MIRALLES, 1973; DE-VILLALOBOS & RESTELLI, 2001).

Distribution – ARGENTINA - Buenos Aires: Sierra de La Ventana, El Loro stream 38°08'00"S, 38°08'00"W

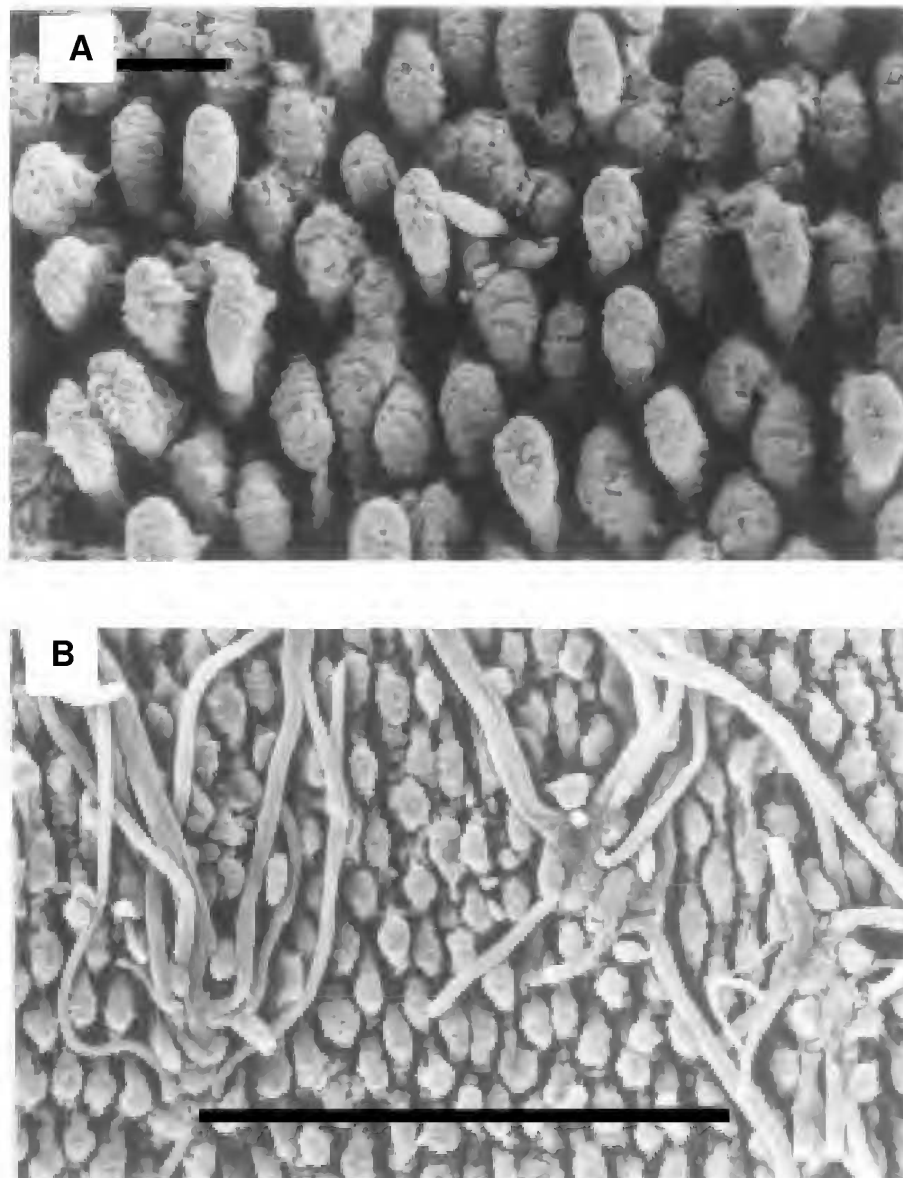


Chordodes nobilii, ♀, SEM – fig.6- (A) MLP 3580, terminal end with radiating fine grooves around the cloacal opening; (C) midbody cuticle with type 1 areoles. (B) MLP 3579, midbody cuticle with type 1 areoles, type 1 areoles and interareolar tubercles; (C) MLP 3580, midbody cuticle with type 1 areoles, type 1 areoles with various shapes and sizes; (D) 3579, cuticle of the ventral midline, overview of the cuticle with crowned areoles with long filaments (type 2); (E) MLP 3579, cuticle of the ventral midline, crowned areoles (type 2) in detail. Scale bars: (A, D-E) = 100µm, (B-C) = 10µm.

(1♂, new record), Sierra de la Ventana 3♀, MIRALLES, 1989), Sierra de La Ventana, Sauce Grande stream 38°05'00"S, 62°13'00"W (4♂, new record), Balcarce 37°45'00"S, 58°18'00" (1♀, new record). Cordoba: Cordoba 31°24'00"S, 64°11'00"W (1♀, new record), Cosquin (1♀, CAMERANO, 1901), Cura Brochero (3♀, MIRALLES, 1989), El Durazno 31°20'15"S, 64°40'09"W (1♂, new record). San Luis: Villa Larca, Aguas Blancas, San Ignacio stream (32° 38'09"S, 64°57'06"W) (2♂, 1♀, new record), Carpinteria, Piedra Blanca stream (1024m) (32°24' 43"S, 64°58'47"W) (3♂, new record).

CONCLUSIONS

This study by SEM allows us to confirm the observations previously made by CARVALHO & FEIO (1950) for *C. carmelitanus* that in females the crown areoles with long filaments are limited to the ventral and/or dorsal and ventral groove. This particular feature in females has been mentioned for other South American species such species such as *C. brasiliensis* (see JANDA, 1894, CAMERANO, 1897; CARVALHO, 1946b), *C. peraccae* (see DE-VILLALOBOS & ZANCA, in press), *C. balzani* (see CARVALHO & FEIO, 1950;



Chordodes nobilii, ♀ (MNB 4437) – fig.7- (A) midbody cuticle, scale bar = 10µm; (B) Nematomorpha, Gordiida, *Chordodes*, South America, scanning electron microscopy. Ventral groove with cluster of crowned areoles surrounded by slightly elevated areoles.

DE-VILLALOBOS *et al.*, 2004). *C. moraisi* (see CARVALHO, 1944; DE-VILLALOBOS & ZANCA, in press), *C. staviarskii* (see CARVALHO & FEIO, 1950; DE-VILLALOBOS & ZANCA, in press) and in the present study for *C. nobilii*. Although more studies are necessary on both sexes of genus *Chordodes* in South America, there seems to be a feature of sexual dimorphism as was considered by CARVALHO (1946b) for the species *C. brasiliensis*, by CAMERANO (1987) and CARVALHO AND FEIO (1950), DE-VILLALOBOS *et al.* (2004) for *C. balzani* and DE-VILLALOBOS & ZANCA (in press) for *C. moraisi* and *C. staviarskii*.

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